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**Vehicle seat, particularly for a motor vehicle,
comprising a folding backrest and a foldable seat base
and method**

- 5 The invention relates to a vehicle seat, particularly for a motor vehicle, comprising a backrest, a seat part and a seat base, the backrest being able to be set into a first position and into a second position by being pivotable relative to the seat part about a first
10 rotary spindle arranged essentially transversely with respect to the main seating direction, and the seat base being able to be set into a third position and into a fourth position by being pivotable relative to the seat part about a second rotary spindle arranged
15 essentially transversely with respect to the main seating direction.

Vehicle seats of this type are known in general and serve, for example, to enlarge the loading area of a
20 motor vehicle. A disadvantage of the known solutions is that a user generally has a plurality of awkward operations in order to change the seat position, i.e., on the one hand, to enlarge the loading area and, on the other hand, to reverse the seat adjustment again,
25 for example for normal transportation of individuals.

The object of the invention, therefore, consists in providing a vehicle seat, particularly a rear seat of a motor vehicle, in such a manner that the vehicle seat
30 can be set rapidly and with few maneuvers or just with one maneuver from its loading position into its normal position and vice versa.

This object is achieved according to the invention by a
35 vehicle seat which has a backrest, a seat part and a seat base, the backrest being able to be set into a first position and into a second position by being

5 pivotable relative to the seat part about a first rotary spindle arranged essentially transversely with respect to the main seating direction, the seat base being able to be set into a third position and a fourth
10 position by being pivotable relative to the seat part about a second rotary spindle arranged essentially transversely with respect to the main seating direction, and the vehicle seat furthermore having transmission means in such a manner that a pivoting movement of the backrest from the first position into the second position is coupled to a pivoting movement of the seat base from the third position into the fourth position. By this means, it is possible that the
15 pivoting movement both of the backrest and of the seat base is possible by a single maneuver, i.e., for example, by moving the backrest or else by moving the seat base or else by actuation of a drive which adjusts both the backrest and the seat base. This makes it possible to considerably simplify the manipulation of
20 the vehicle seat into the one or other position and also to carry it out more rapidly.

It is preferred that the spatial region taken up by the backrest in the second position at least partially
25 overlaps the spatial region taken up by the seat base in the third position. The effect achieved by this is that a particularly large change in the capacity of the loading space is possible by the fact that the seat back or the backrest is set comparatively flat to be
30 precise, in a region in which the seat base or the seat cushion part was at least partially arranged beforehand.

Furthermore, it is preferred that the first and second
35 rotary spindles are provided essentially parallel to each other, essentially horizontally and, in the main seating direction, essentially at opposite ends of the

seat part. The effect firstly achieved by this is that the possibility of adjustment can be realized in a particularly simple and robust manner and, secondly, that, in turn, the capacity of the loading space can be 5 considerably enlarged by the backrest being fastened rotatably, for example, in the rear part of the seat part and the seat base being fastened rotatably in the front part of the seat part, so that, by folding the backrest downward and by folding the seat base upward, 10 a gain in space in the longitudinal direction can be realized of the order of magnitude of the length of the seat back or of the backrest.

Furthermore, it is preferred if the transmission means 15 comprise a first rail and a second rail, with, on the one hand, a fifth position of the rails relative to each other corresponding to the first position of the backrest and the third position of the seat base, and, on the other hand, a sixth position of the rails 20 relative to each other corresponding to the second position of the backrest and the fourth position of the seat base. By this means, it is possible, according to the invention, for an adjusting mechanism to be realized which can be realized, in the case of a 25 vehicle seat, in a particularly compact manner in terms of construction space and therefore also comparatively cost-effectively.

Furthermore, it is preferred that a longitudinal 30 displacement of the rails relative to each other takes place between the fifth position of the rails and the sixth position of the rails. In this case, the longitudinal displacement of the rails is particularly preferred and the element connecting the adjustment of 35 the backrest and the seat base is particularly advantageous.

Furthermore, it is preferred that the vehicle seat has locking means in such a manner that the rails can be locked with respect to a longitudinal displacement. In general, the locking means bring about a locking of the transmission means irrespective of the manner in which the transmission means are configured. By this means, the setting of the vehicle seat or the setting of the backrest and of the seat base can advantageously be provided in a lockable manner, so that situations critical to safety, for example in the case of accident situations, do not arise from the expanded and improved possibilities of adjusting the vehicle seat.

It is also preferred that a drive is assigned to the rails or in general to the transmission means in such a manner that, by means of the drive, a setting of the rails from their fifth position into their sixth position can be brought about. By this means, it can be provided in a particularly convenient manner that the adjustment of the backrest and of the seat base is designed in a manner such that it can be automated and therefore such that it is advantageously even more convenient than is possible solely by connecting the adjustment of the backrest to the adjustment of the seat base via the transmission means. Furthermore, this embodiment advantageously opens up the possibility of using the drive both for adjusting the backrest and for adjusting the seat base.

It is preferred that the drive is provided electrically and/or pneumatically and/or hydraulically. By this means, use can be made of any actuator, for example a linear actuator, for the adjustment of the seat.

A further subject matter of the invention is a method for adjusting the backrest and the seat base of a vehicle seat according to the invention, the setting of

the backrest from its first position into its second position and the setting of the seat base from its third position into its fourth position taking place at the same time. By this means, it is possible in a 5 particularly advantageous manner to design the adjustment of the vehicle seat to be particularly rapid and also particularly simple for a user.

Furthermore, it is preferred that the setting of the 10 backrest from its second position into its first position and the setting of the seat base from its fourth position into its third position also take place at the same time. By this means, it is particularly advantageously possible that the accelerated adjustment 15 of the vehicle seat can be used for both directions, i.e. both for setting the loading position and for setting the normal position.

The invention is explained in more detail below with 20 reference to figures illustrated in the drawing.

Figures 1

and 2 show the supporting parts of a vehicle seat according to the invention which is set in 25 two variants in its normal position,

Figures 3

and 4 show the vehicle seat according to the invention which is set in its loading 30 position, in two different position variants,

Figure 5 shows, in plan view and in side view, a locking means according to the invention of the vehicle seat,

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Figures 6,

7 and 8 show details of the locking means according

to the invention in each case in two different illustrations.

The seat according to the invention is provided in particular as a rear seat of a motor vehicle and comprises a seat base which can be pivoted out and adjusted, an adjustable and pivotable seat back or backrest, and a transmission means realized, by way of example, by means of two rails, the rails being displaceable horizontally one inside the other. In order to enlarge the loading area, the seat back or the backrest can be pivoted from the upright position (which is variable within limits) toward the rails or toward the floor platform into a horizontal cargo position or loading position. In order to take up this loading position, it is provided according to the invention that the seat base or the seat cushion part is pivoted out in advance, so that the backrest can at least partially take up the space or the spatial region of the seat base. For this purpose, in order to avoid a collision between the seat base or the upholstery of the seat base and the seat back or the backrest, this seat base already has to be swung over with respect to the backrest from the use position into the loading position or into the cargo position before the seat back is swung forward into the essentially horizontal position. For this purpose, by way of example, the seat base is driven via a swinging articulated arm by the upper of the two rails and via the lower rail. During the pivoting of the backrest, which, for its part, is connected to the lower rail, for example via a separate main strut, an intermediate joint and a carry-along joint fitted on the upper rail are used to trigger a displacement of the upper rail and therefore to bring about a pivoting out of the seat base. As the seat back is being placed into an upright position by a hand movement or via a mechatronically caused displacement

of the upper rail on the lower rail, the same device brings about the automatic pivoting in of the seat base and the raising of the seat back. In this manner, it is possible, according to the invention, to enlarge the 5 loading space of a vehicle and to increase the ease of operation for the folding-over of the seat back with little structural outlay and to reduce the maneuvering to a minimum.

10 Figures 1 and 2 each illustrate side views of a vehicle seat 25 according to the invention and of its structure-forming parts in two normal positions. The normal positions are distinguished in that the vehicle seat 25 can be used as a seat for an occupant of a 15 vehicle or a motor vehicle, i.e. that a seat back 1 or backrest 1 of the vehicle seat 25 is arranged essentially vertically or inclined slightly to the rear and that a seat base 8 is arranged essentially horizontally - in a position also referred to as the 20 third position. Figure 1 illustrates a seat position, which is also referred to below as the first position, in which the backrest 1 is set somewhat more vertically, and Figure 2 illustrates a position of the vehicle seat 25, in which the backrest 1 is set 25 somewhat inclined to the rear. The backrest can be varied between these two positions without the seat base moving.

Figures 3 and 4 show the vehicle seat 25 and its 30 structure-forming parts in two different loading positions which are also referred to as cargo positions. The seat back 1 here is in each case arranged essentially horizontally in a position which is also referred to as the second position, and the 35 seat base 8 is provided in a manner in which it is unfolded from its folded-in position in the normal position, and in the unfolded position is either set

essentially vertically - which is also referred to below as the fourth position and which is illustrated in Figure 3 - or is set essentially horizontally, as illustrated in Figure 4.

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The vehicle seat 25 illustrated in Figures 1 to 4 comprises a first (lower) rail 5 and a second (upper) rail 6. According to the invention, the rails 5, 6 are provided, in particular, on both sides of the seat 25 thus making it also possible to speak of a lower pair of rails 5 and of an upper pair of rails 6. However, it could equally well also be possible for the two rails 5, 6 to be arranged only, for example, in the center or on one side of the seat 25. One of the pairs of rails 5, 6, in particular the lower one or one of the rails 5, 6 is fastened, for example screwed, to the vehicle body (not illustrated). Alternatively, the pair of rails connected fixedly to the body can also be fastened to a seat substructure. The pair of rails fixed in such a manner or the fixed rail is also referred to below as the "seat part" and is provided in Figure 1 with the reference number 24. The situation in which an upper and a lower rail 5, 6 is arranged in each case on both sides of the seat 25 is illustrated below. The vehicle seat 25 furthermore comprises the seat base 8 and the backrest 1 which are normally provided with cushion elements (not illustrated). At its rear end, the lower pair of rails 5 comprises a pair of upwardly protruding tabs. A main point of articulation 3, through which a rotary spindle 3 passes, is arranged thereon. With regard to the first rotary spindle 3 or the main point of articulation 3, the backrest 1 is connected rotatably to the lower rail 5. This is realized according to the invention by way of example by means of a "main strut" 2 which is connected fixedly to the backrest 1 and is likewise connected rotatably about the first rotary spindle 3 to

the lower rail 5 or to the first rail 5. The main strut 2, which, according to the invention, can likewise be provided as a pair of main struts 2 on both sides of the seat 25, or the backrest 1 is connected rotatably 5 by means of a first joint 4 to "carry-along joints" 7 (or to one carry-along joint 7), the carry-along joint 7 being connected rotatably on its side opposite the first joint 4 via a second joint 13 to the upper rail 6 or, in the embodiment on both sides, to the upper pair 10 of rails 6. This arrangement of joints brings about a pivoting or tilting of the backrest 1 about the first rotary spindle 3 or a displacement in the longitudinal direction of the rails 5, 6, with the relative position of the rails 5, 6 before the forward movement of the 15 backrest 1 (i.e. the relative position of the rails 5, 6 that is illustrated in Figure 1) being referred to as the fifth position, and the relative position of the rails 5, 6 after the forward movement of the backrest 1 (i.e. the relative position of the rails 5, 6 that is 20 illustrated in Figure 3) being referred to as the sixth position.

Such an embodiment of a vehicle seat 25 permits a three-point kinematic arrangement which resembles an 25 oblique-angled triangle between the main point of articulation 3 or the first rotary spindle 3, the first joint 4 and the second joint 13 and which, in the normal position or use position, forms an angle between the alignments of first rotary spindle 3 and first 30 joint 4, on the one hand, and first joint 4 and second joint 13, on the other hand, with, in the cargo position illustrated in Figures 3 and 4, an essentially aligned arrangement between first rotary spindle 3, first joint 4 and second joint 13 being provided, 35 although, even in the cargo position, a complete alignment should not be provided.

At the front end of the seat 25, a displacement of the rails 5, 6 causes the seat base 8 to rotate about a second rotary spindle 10. The second rotary spindle 10 is provided on the upper rail 6, so that the seat base 5 8 is connected at least indirectly to the upper rail 6 at the second rotary spindle 10. However, in the region of the second rotary spindle 10, the seat base 8 is also connected at least indirectly to the lower rail 5, so that a displacement of the rails 5, 6 leads to a 10 pivoting of the seat base 8. In the present exemplary embodiment of the seat 25, the seat base 8 is connected to a rocker-type articulated arm 9, the rocker-type articulated arm 9 being connected to the upper rail 6 at the second rotary spindle 10 and being connected to 15 the lower rail 5 by means of an elongated slot 20.

According to the invention, the seat base 8 can either be connected rigidly to the rocker-type articulated arm 9 or the seat base 8 can be coupled rotatably to the 20 rocker-type articulated arm 9 via a pivot joint 11, so that a rotation of the seat base 8 about the pivot joint 11 is possible (as apparent by comparing Figures 3 and 4), with, however, a stop 23, indicated in Figures 1 and 2, preventing the seat base 8 being 25 pivotable with respect to the rocker-type articulated arm 9 further, than illustrated in Figure 3, in the direction of the lower rail 5. This has the effect that, when the rocker-type articulated arm 9 is pivoted out by a displacement of the rails 5, 6, the seat base 30 8 is also carried along, i.e. is pivoted out about the second rotary spindle 10. The displacement of the rails 5, 6 therefore results in a coupled, synchronous kinematic control of the four-point kinematic arrangement between the second joint 13, which is 35 mounted in a horizontally rotatable manner on the upper rail 6, and the second rotary spindle 10 - also referred to as the third joint 10 below - , and which

is mounted on the same upper rail 6 in a horizontally rotatable manner in the front region of the seat 25 and, in the example, is connected to the seat base 8 via the rocker-type articulated arm 9. In the rear 5 region of the seat 25, the seat base 8 is mounted or supported on a support 22 on the lower rail 5 or on the upper rail 6. In such an embodiment, a parallelogram is produced between the second joint 13, the second rotary spindle 10, the pivot joint 11 and the support 22, 10 which parallelogram is essentially closed upward in the use position and, on the basis of a displacement of the rails 5, 6, is pivoted open synchronously in a limited and controlled manner, as illustrated in Figure 3. In the case of a horizontal, manual pivoting over of the 15 seat base 8 about the pivot joint 11, starting from the cargo position illustrated in Figure 3, an expanded cargo position, as depicted in Figure 4, arises which, when the seat 25 is folded back into its use position, also has to be folded over again manually.

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According to the invention, the carry-along joint 7 is provided at the first joint 4 in particular with a shaped toothed 16 which is arranged in a further shaped toothed 15 on the backrest 1 or on the main 25 strut 2. Such an arrangement of the carry-along joint produces a controllable three-point kinematic arrangement between the main point of articulation 3 and the first joint 4. A movement can now take place from two directions: either, starting from a movement 30 of the backrest 1 (or of the seat base 8), a displacement of the rails 5, 6 can be brought about or, by means of a displacement of the rails 5, 6, a movement of the backrest 1 and of the seat base 8 can be brought about. In the front region of the seat 25, 35 in the case of the position of the seat base 8 with respect to the rocker-type articulated arm 9 that is illustrated in Figures 1 and 3, the rocker-type

articulated arm 9 is aligned essentially perpendicularly with respect to the seat base 8. A cam 20a connected to the lower rail 5 engages in the elongated slot 20 provided on the rocker-type articulated arm 9, as a result of which a slightly changed setting of the backrest 1, i.e. in different normal positions, owing to the elongated hole 20, does not lead to a movement of the seat base 8 or of the rocker-type articulated arm 9; on the contrary, this only actually takes place when an essentially complete forward folding of the backrest 1 is initiated.

A drive for the seat adjustment of the seat 25 can be seen in arranging a rotatable threaded rod (not illustrated) in the region of the rails 5, 6, so that a rotation of the threaded rod leads to a displacement of the rails 5, 6 one inside the other and therefore to a movement of the seat parts. Use can equally well also be made of any desired electric, pneumatic and/or hydraulic linear drive for displacing the rails. Use should preferably be made of a drive which leads to a locking of the arrangement, so that locking means are no longer required. This is the case, for example, when a threaded rod is used. The rails 5, 6 are therefore displaced only when the drive is actuated in order to rotate the threaded rod, and are therefore also unlocked. By means of such a solution, the backrest can be set in an infinitely variable manner (in the normal position) and the seat adjustment between normal position and cargo position is also possible in an infinitely variable manner.

If an automatic drive of the seat 25 for the seat adjustment is not provided, the invention makes provision for a locking of the movement mechanism of the seat 25 to be provided by means of a locking means. A locking means of this type consists, for example, in

a toothing 18 on the lower rail 5 and a further toothing 19 on the upper rail 6. By means of a clamp 17, which is preferably fastened to the upper rail 6 and which can engage in the toothings 18, 19 of the rails 5, 6, a locking of the seat is possible. As a result, the end position of the backrest 1 in the normal position of the seat 25 can be defined, with the clamp 17 then bringing about a locking when the toothings 18, 19 lie congruently one above the other.

This is the case in a plurality of normal positions of the seat 25, i.e. for a plurality of angles of inclination of the backrest 1 in its normal position, cf. Figures 1 and 2, because, for example, the toothing 18 has a larger number of gaps than the clamp 17 has teeth. The additional, expanded adjustment of the backrest in the normal position is limited by the number of gaps in the toothing 18 and by the length of the elongated hole 20. The clamp 17 can be designed as a spring and can be provided in a manner such that it can be unlocked via an unlocking lever 12. According to the invention, the toothings 18, 19 are, in particular, only lockable in the use position or normal position of the seat or of the backrest 1. By this means, a stepped pivoting of the seat back into the use position and a controlled lowering of the backrest are possible with the use of a single blocking device or locking device or locking means. In order to prevent an occupant from sitting down on a seat 25 which is not yet locked in the use position, it can also be provided that a spring element (not illustrated) is provided between the rails 5, 6 in such a manner that the spring tension pulls the seat into the cargo position and only when locking has taken place does the spring element no longer exert any force on the user. This spring force can also provide the occupant with an easy and synchronous frictional connection to assist in the adjustment of the seat back.

Figures 5 to 8 illustrate details of the locking means. Figure 5 illustrates, in the upper part of the figure, a plan view of an upper and lower rail 5, 6 together with the clamp 17. In the lower part of Figure 5, a side view of upper and lower rail 5, 6 together with their toothings 18, 19, the clamp 17 and the unlocking lever 12, which is fastened via a third joint 21, is illustrated. In this case, the positive Z axis refers to the vertical axis of the vehicle in the upward direction, the positive X axis refers here to the longitudinal axis of the vehicle in the direction of travel, and the positive Y axis refers here to the transverse axis of the vehicle in such a manner that a clockwise-rotating coordinate system arises from the X, Y and Z axes. Figure 6 illustrates a side view in the upper part of the figure and, in the lower part of the figure, a plan view of the clamp 17. Figure 7 illustrates a front view in the upper part of the figure and, in the lower part of the figure, a side view of the upper rail 6. Figure 8 illustrates a front view in the upper part of the figure and, in the lower part of the figure, a side view of the lower rail 5. The clamp 17 can be provided riveted to the upper rail 6.

List of Reference Numbers

- 1 Seat back or backrest
- 2 Main strut
- 5 3 First rotary spindle
- 4 First joint
- 5 First (lower) rail
- 6 Second (upper) rail
- 7 Carry-along joint
- 10 8 Seat base
- 9 Rocker-type articulated arm
- 10 Second rotary spindle
- 11 Pivot joint
- 12 Unlocking lever
- 15 13 Second joint
- 15 Further shaped toothing
- 16 Shaped toothing
- 17 Clamp
- 18 Toothing
- 20 19 Further toothing
- 20 Elongated hole
- 20a Cam
- 21 Third joint
- 22 Support
- 25 23 Stop
- 24 Seat part
- 25 Vehicle seat